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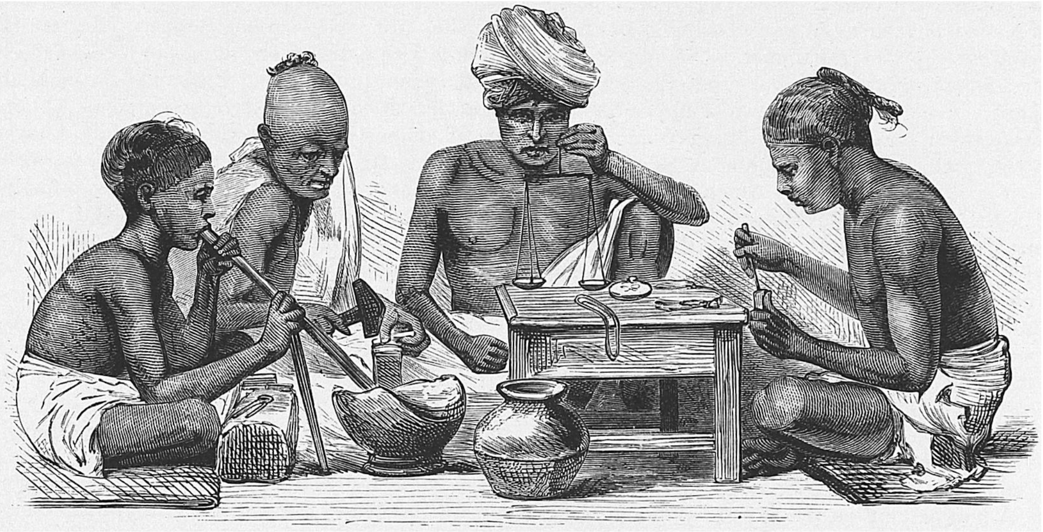
METAL-WORK AMONG THE HINDOOS.*

BY DR. ALEXANDER HUNTER.

MANUFACTURES IN STEEL.

THE wootz steel of India has long been celebrated for one peculiar property, which gives it a value in most markets of the world; this is its dense toughness. The process of manufacture is peculiar, but thoroughly scientific. In some districts of Southern India, as Coimbatore, Salem, Masulipatam, and the Deccan, a very rich and nearly pure magnetic ore is selected, which has a bright metallic and almost silvery fracture. This is broken into small fragments, and is enclosed in a series of crucibles, made of sizes to contain each 1 lb., 2 lbs., or 4 lbs. Along with the ore is enclosed a bundle of leaves of the *Acclepias gigantea*, or some species of *Calotropis*, plants containing a viscid milky juice, rich in hydro-carbon. The crucibles are made of a whitish yellow clay, very slightly ferruginous, and containing kaolin, or porcelain earth; occasionally magnesian clay is added, to give toughness and density to the larger crucibles. When filled with the broken ore and leaves, a top is carefully luted on each, and they are arranged in a circular form in a furnace, the blast heat of which is kept up with large bellows, made of cows' hides inflated, and worked in pairs with the right and left hand alternately.

The fuel employed is hard, dense charcoal, made of the wood of the babool, or some species of acacia. When the steel is melted, the heat is kept up steadily for an hour or more, and the furnace-mouths are closed with clay to exclude cold air, and to allow the metal to cool slowly. Next day the crucibles, when cold, are broken, and the lumps of steel removed and sorted into the different sizes for knives or small tools, daggers, spear-heads, or sword-blades. The lumps of steel are called oollies, and they find a ready sale in most of the markets of India, at prices varying from six to eight annas, or one shilling, a pound. Till very lately there was a considerable export trade of Indian wootz steel from Hyderabad, Masulipatam, the Deccan, and Berar, to Upper India, Persia, and Damascus, the oollies being carried on donkeys and ponies by Byraghies and wandering tribes, who live by this trade. One of the peculiarities of this steel is its malleability and ductility, combined with great toughness; it requires to be worked, however, in a peculiar way, as it is easily spoilt if the heat be too great. The general rule is not to urge it beyond a dull cherry red, and not to keep it too long in the fire, as it becomes brittle and liable to crack if made white hot. Very heavy hammers are used in proportion to the size of the work, and the more rapid the hammering, the better are the tools or weapons. If the heat has been too great the steel is spoiled, and it cannot again be restored to its pristine malleability. The reason for this is, that a portion of the carbon has been burned away, and the metal has been reduced to a hard, brittle iron, which opens into cracks and will not weld. To remedy this defect it is beaten out with soft malleable iron in bars, and embedded in fresh charcoal, and covered with pieces of hoofs and horns, or old leather, and thus partially converted again into a soft steel.


Group of Natives.

In several districts of Southern India a rich natural steel sand, containing titanium, is employed; this yields a very silvery-looking steel of great density, and which does not easily rust. In the districts of Masulipatam, Guntoor, and the Northern Circars, another variety of very soft malleable steel is made from a very peculiar ore, alternately metallic and rusty in the fracture; this ore is not melted in crucibles, but is merely hammered, puddled, and then frequently cut and welded. This ore being very rich in metal (from 74 to 84 per cent.), yields by the one process an impure but very malleable steel, that is much prized for making very pliant sword-blades and the barrels of native guns and matchlocks. There was formerly a considerable market for this quality of steel in Hyderabad, from whence it was exported to Umbala, Sealkot, Umritsur, and Lahore; but the operation of the Arms Act has done much to diminish the demand for weapons all over India. Agricultural implements are now taking the place of weapons, and manufactures of cutlery, tools, surgical and other instruments, are being introduced into many of the workshops and arsenals of India. The districts which have been most celebrated for cutlery, small tools, hunting-knives and spear-heads, are Salem, Coimbatore, Nagpore, Sealkot, and Delhi. Where the demand for weapons reaches beyond our frontier, as in Kashmir, Peshawur, and the Punjab, men of considerable skill still keep up some very beautiful manufactures in steel, and most of the independent princes and rajahs of India have expert workmen in their employ. Those who inlay steel with gold are called koftgars. Those who clean and brighten arms are sikligars, or, in Southern India, chikledars; many of the latter are very skilful cutlers, and can make the most delicate and finished surgical instruments. For the last thirty years Arnachellum, of Salem, has perhaps acquired the greatest and the most deserved reputation for the fine quality, as well as the finish, of his knives, hunting-spears, daggers, and table-cutlery. One point in which these have surpassed almost all similar steel-manufactures in Europe, has been their tough hardness, without being brittle; the hunting-knives and spear-heads being found to resist blows on granite without being chipped. Fine Indian tools and cutlery are not liable to rust, and if the surface does oxidise, it is to such a trifling depth that it can be easily removed by friction.

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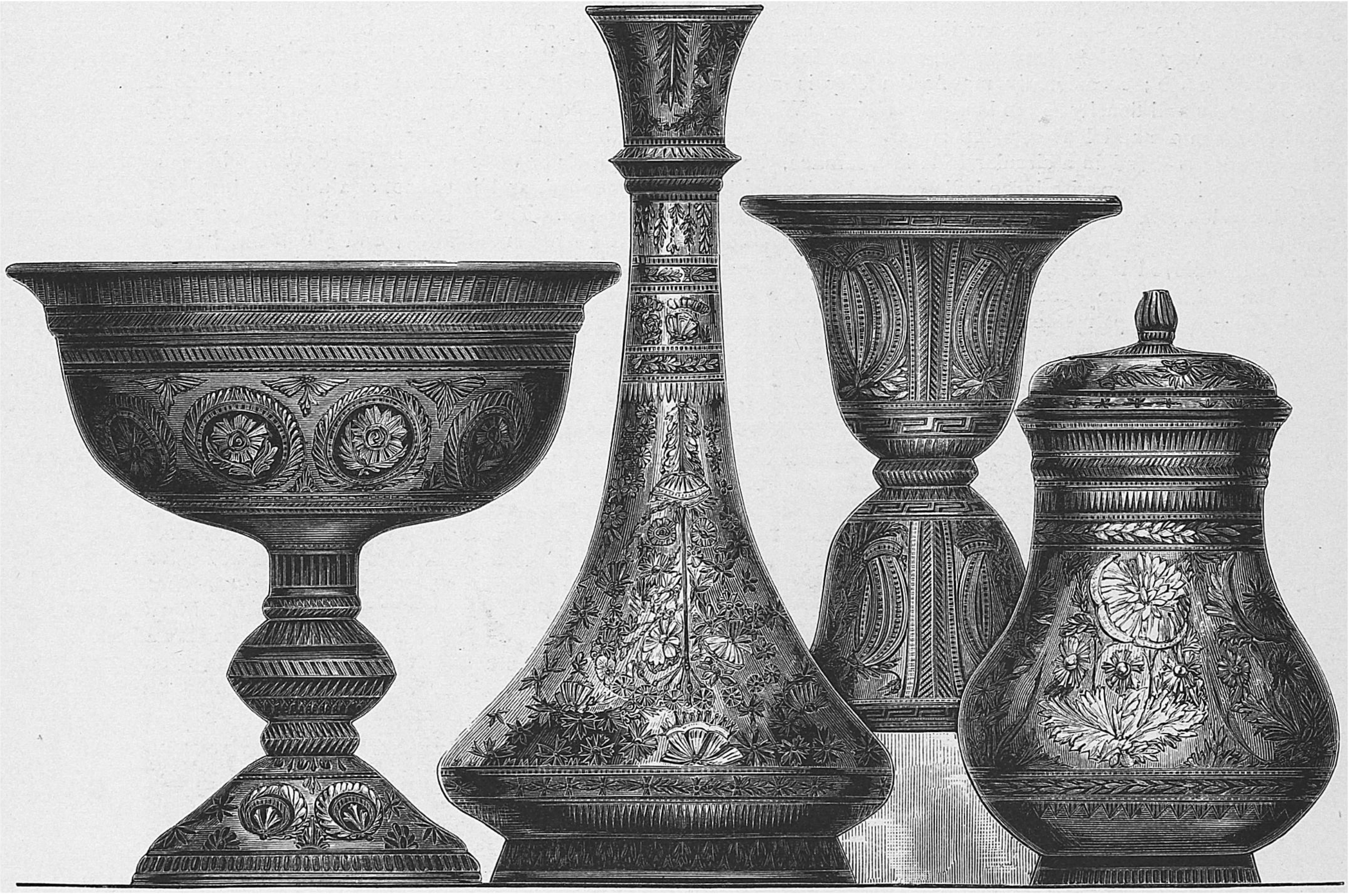
* Continued from page 40.

KOFTGARI MANUFACTURES.

As a general rule, the native workmen of India employ fewer tools than are used in similar manufactures in Europe; but there is this important difference, that nearly every workman in India begins his apprenticeship by learning to make, temper, and sharpen, the tools he employs in his occupation or handicraft. This is a most important part of Eastern training, as it teaches the workmen the properties of steel and iron, and makes them careful of their tools. The method of drawing the patterns on the steel is varied according to the depth of the lines or the style of ornamentation. A strong steel drawpoint, of eight or ten inches in length, and the thickness of a pencil, is tapered to a point at one end, the other being shaped like a chisel, sharp for scraping at one side, rounded for polishing or rubbing when turned to the other side. With this tool the pattern is drawn, and the flat end is used to correct or obliterate mistakes. The surface to be decorated is first made smooth by scraping, burnishing, and polishing, with a rubber made of pounded and sifted corundum, or emery, mixed with shell-lac, heated and pressed into a mould; it is then polished with pounded pumice, and left a little dull, but free from scratches. To prepare the surface for receiving the drawing, the steel is smeared with tallow or oil, and exposed to heat over a charcoal fire; or it is sometimes merely blackened by holding over a lighted flame of cotton dipped in oil; the superficial coating of soot is wiped off, and the heat applied repeatedly, till the steel or iron has acquired a dark colour. Another process for blackening the surface is to mix about equal parts of alum, salt, and sulphate of copper in water, apply the solution, and expose the surface to heat in an open charcoal-fire, throwing some pieces of horn or leather into the fire. This is a rough-and-ready way of producing prussiate of iron on the surface. If the heat be continued, a deep purplish blue is given to the steel, and through this the pattern is drawn by scratching with the pointed tool. If a very elaborate pattern has to be executed, it is first drawn upon paper with a pencil, or pen and Indian ink; the back of the paper is then rubbed over with finely scraped soapstone or balapum. The drawing is fixed in its place with little pieces of wax, and the pattern is traced through with an ivory point. The soapstone leaves a fine white line, which is not easily obliterated after the paper is removed. The same outline can be used five or six times if it be drawn on good paper and not used roughly. Skilled workmen often prefer to make the drawing directly on the blackened surface without using paper, and by practice they acquire a wonderful amount of freedom and rapidity of drawing. There are two distinct methods of ornamenting steel or iron—one by deeply engraved lines, executed with an ordinary graver's tool, and filled with a black mixture resembling hard sealing-wax. By the other process the lines are gone over and made of uniform depth with small punches resembling blunt steel-chisels. Into these lines, the edges of which are a little raised, fine silver or gold wire of great purity is inserted. The wire is prepared by being drawn through steel-plates; it is then dipped into a strong solution of borax, and inserted carefully into the lines. The flat end of the etching tool is then drawn firmly over the surface, to press in the metal wire. Pounded dammer, or resin, is next rubbed all over the pattern, and heat is applied to melt it. The surface is then well beaten all over, while hot, with a polished steel hammer, and again heated to dissipate the resin. It is next rubbed with pumicestone, and burnished with an agate burnisher. The pattern is then carefully examined, repaired, and corrected if necessary; and, lastly, it is polished with red oxide of iron, or colcothar, made by calcining sulphate of iron (green vitriol).


Group of Vases.

In this way steel swords, daggers, elephant-goads, armour, handles of knives, battle-axes, spears, weapons, and state umbrella-handles, are ornamented most tastefully. The amount of labour and skill that is often expended upon a single small article of no intrinsic value surprises Europeans; but where the workmen, as is often the case, are in the employ of some wealthy rajah, upon whose bounty and liberality the whole family is dependent, time and labour are not of so much consequence as manipulative skill and tasteful finish. This principle is applied to nearly all the best Art-industries of India; and for many centuries the wealthy rajahs and zemindars have prided themselves on the encouragement of some particular manufacture, which by this means has been fostered and brought to great perfection. A very curious and important result of this system has been the training of large families to special industries, and the careful retention of these in particular districts or villages. Caste-prejudices have also contributed in no small degree to keep up the practice, which has some good points to recommend it, though there are objections to the system also, the most serious of which is, that an industry often dies out in a village by the death of the rajah who encouraged it, or by the decease of the most skilled workmen.

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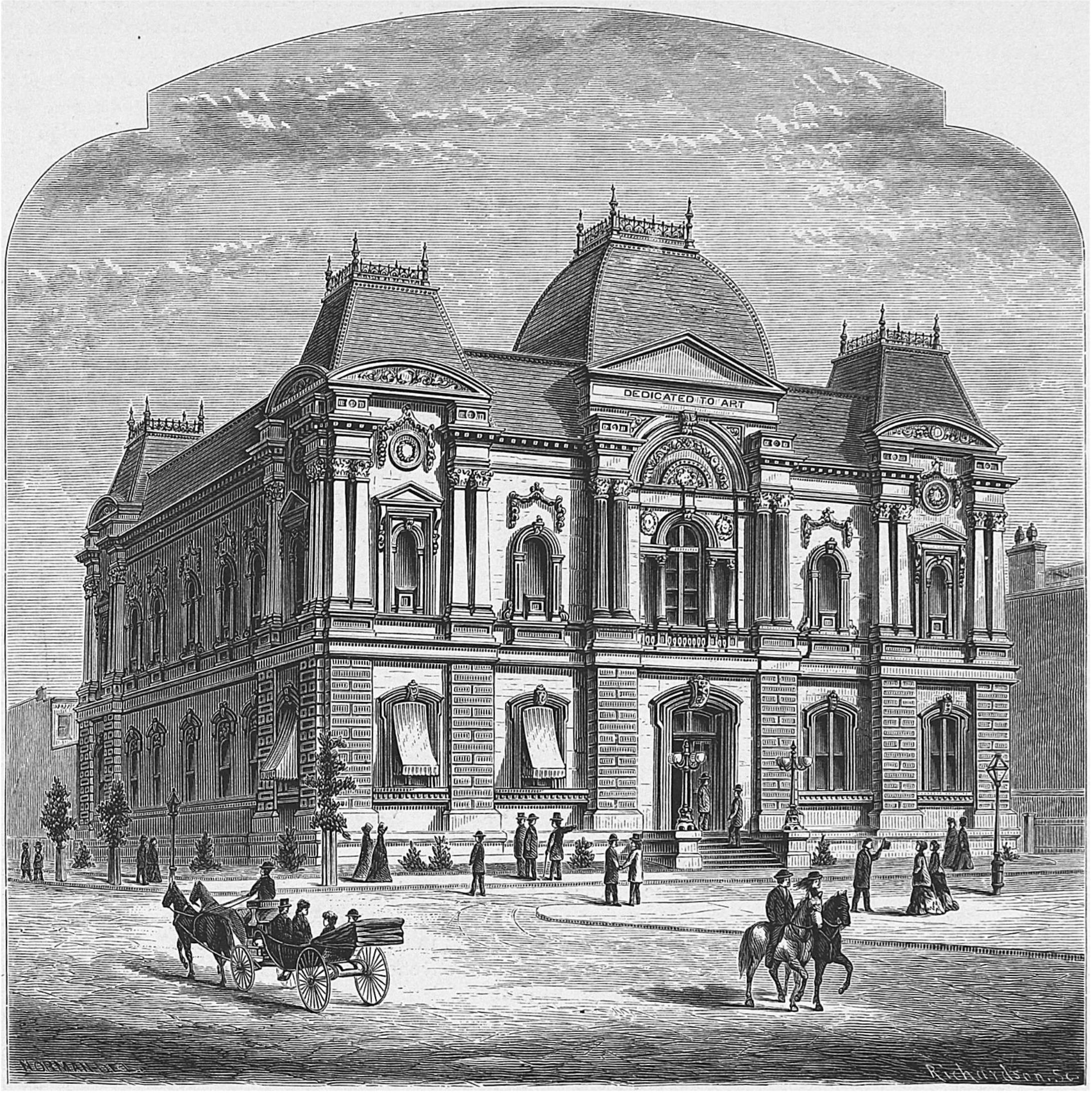
DEDICATED TO ART
NORMAN. SC.
Richardson. Sc.

THE CORCORAN GALLERY OF ART, IN WASHINGTON.

THE Corcoran Gallery of Art, in Washington, of which we give an engraving, is situate on the corner of Pennsylvania Avenue and Seventeenth Street, opposite the War Department. The building was erected in 1860, in accordance with a long-cherished desire, on the part of Mr. William W. Corcoran, its founder, to establish an institution in the city of Washington to be devoted to Art-purposes, and particularly, the encouragement of American genius. The plans were drawn by James Renwick, but the breaking out of the war of the rebellion prevented the completion of the edifice, and for several years it was occupied by the Quartermaster-General's Department. The structure is of the French Renaissance order of architecture, two stories high, surmounted with a Mansard roof and a dome over the principal entrance. The material is of pressed brick, relieved with brown-stone trimmings, and niches at suitable points for statuary. It has a front of 100 feet on Pennsylvania Avenue, and 115 feet on Seventeenth Street, and is fire-proof. The principal entrance is on the Avenue, and a grand doorway opens to the spacious vestibule, from which a stone staircase, ten feet wide, leads to the main gallery. This broad staircase is composed of three flights, of twelve steps each.

On the first floor, broad halls, on either side of the great staircase, lead to a large gallery in the north end of the edifice, which is 95 by 30 feet in size. A large room, used as a library, and a smaller apartment communicate with this gallery. On the east side of the building are the janitor's rooms and a small gallery. The several galleries on this floor are devoted to the exhibi-